

APPENDIX C TO PART 229—FRA LOCOMOTIVE STANDARDS—CODE OF DEFECTS

EDITORIAL NOTE: Appendix C, published at 45 FR 21121, Mar. 31, 1980, as part of the original document, is not carried in the CFR.

APPENDIX D TO PART 229—CRITERIA FOR CERTIFICATION OF CRASHWORTHY EVENT RECORDER MEMORY MODULE

Section 229.135(b) requires that certain locomotives be equipped with an event recorder that includes a certified crashworthy event recorder memory module. This appendix prescribes the requirements for certifying an event recorder memory module (ERMM) as crashworthy, including the performance criteria and test sequence for establishing the crashworthiness of the ERMM as well as the marking of the event recorder containing the crashworthy ERMM.

A. GENERAL REQUIREMENTS

1. Each manufacturer that represents its ERMM as crashworthy shall, by marking it as specified in Section B of this appendix, certify that the ERMM meets the performance criteria contained in this appendix and that test verification data are available to a railroad or to FRA upon request.

2. The test verification data shall contain, at a minimum, all pertinent original data logs and documentation that the test sample preparation, test set up, test measuring devices and test procedures were performed by designated, qualified personnel using recognized and acceptable practices. Test verification data shall be retained by the manufacturer or its successor as long as the specific model of ERMM remains in service on any locomotive.

3. A crashworthy ERMM shall be marked by its manufacturer as specified in Section B of this appendix.

B. MARKING REQUIREMENTS

1. The outer surface of the event recorder containing a certified crashworthy ERMM shall be colored international orange. In addition, the outer surface shall be inscribed,

on the surface allowing the most visible area, in black letters on an international orange background, using the largest type size that can be accommodated, with the words CERTIFIED DOT CRASHWORTHY, followed by the ERMM model number (or other such designation), and the name of the manufacturer of the event recorder. This information may be displayed as follows:

CERTIFIED DOT CRASHWORTHY

Event Recorder Memory Module Model Number

Manufacturer's Name

Marking "CERTIFIED DOT CRASHWORTHY" on an event recorder designed for installation in a railroad locomotive is the certification that all performance criteria contained in this appendix have been met and all functions performed by, or on behalf of, the manufacturer whose name appears as part of the marking, conform to the requirements specified in this appendix.

2. Retro-reflective material shall be applied to the edges of each visible external surface of an event recorder containing a certified crashworthy ERMM.

C. PERFORMANCE CRITERIA FOR THE ERMM

An ERMM is crashworthy if it has been successfully tested for survival under conditions of fire, impact shock, static crush, fluid immersion, and hydro-static pressure contained in one of the two tables shown in this section of appendix D. (See Tables 1 and 2.) Each ERMM must meet the individual performance criteria in the sequence established in Section D of this appendix. A performance criterion is deemed to be met if, after undergoing a test established in this appendix D for that criterion, the ERMM has preserved all of the data stored in it. The data set stored in the ERMM to be tested shall include all the recording elements required by §229.135(b). The following tables describe alternative performance criteria that may be used when testing an ERMM's crashworthiness. A manufacturer may utilize either table during its testing but may not combine the criteria contained in the two tables.

TABLE 1—ACCEPTABLE PERFORMANCE CRITERIA—OPTION A

Parameter	Value	Duration	Remarks
Fire, High Temperature	750 °C (1400 °F)	60 minutes	Heat source: Oven.
Fire, Low Temperature	260 °C (500 °F)	10 hours	
Impact Shock	55g	100 ms	½ sine crash pulse.
Static Crush	110kN (25,000 lbf)	5 minutes	
Fluid Immersion	#1 Diesel, #2 Diesel, Water, Salt Water, Lube Oil.	Any single fluid, 48 hours.	
.....	Fire Fighting Fluid	10 minutes, following immersion above.	Immersion followed by 48 hours in a dry location without further disturbance.

TABLE 1—ACCEPTABLE PERFORMANCE CRITERIA—OPTION A—Continued

Parameter	Value	Duration	Remarks
Hydrostatic Pressure	Depth equivalent = 15 m. (50 ft.).	48 hours at nominal temperature of 25 °C (77 °F).	

TABLE 2—ACCEPTABLE PERFORMANCE CRITERIA—OPTION B

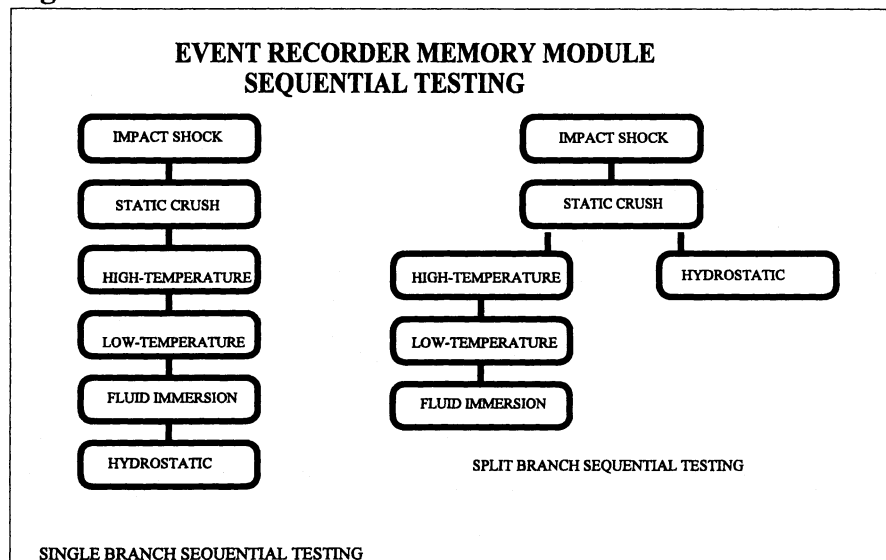
Parameter	Value	Duration	Remarks
Fire, High Temperature	1000 °C (1832 °F)	60 minutes	Heat source: Open flame.
Fire, Low Temperature	260 °C (500 °F)	10 hours	Heat source: Oven.
Impact Shock—Option 1	23gs	250 ms.	
Impact Shock—Option 2	55gs	100 ms	½ sine crash pulse.
Static Crush	111.2kN (25,000 lbf)	5 minutes.	
	44.5kN (10,000 lbf)	(single “squeeze”)	Applied to 25% of surface of largest face.
Fluid Immersion	#1 Diesel, #2 Diesel, Water, Salt Water, Lube Oil, Fire Fighting Fluid.	48 hours <i>each</i> .	
Hydrostatic Pressure	46.62 psig (= 30.5 m. or 100 ft.).	48 hours at nominal temperature of 25 °C (77 °F).	

D. TESTING SEQUENCE

In order to reasonably duplicate the conditions an event recorder may encounter, the ERMM shall meet the various performance criteria, described in Section C of this appendix, in a set sequence. (See Figure 1). If all tests are done in the set sequence (single branch testing), the same ERMM must be

utilized throughout. If a manufacturer opts for split branch testing, each branch of the test must be conducted using an ERMM of the same design type as used for the other branch. Both alternatives are deemed equivalent, and the choice of single branch testing or split branch testing may be determined by the party representing that the ERMM meets the standard.

Figure 1



E. TESTING EXCEPTION

If a new model ERMM represents an evolution or upgrade from an older model ERMM that was previously tested and certified as meeting the performance criteria contained in Section C of this appendix, the new model ERMM need only be tested for compliance with those performance criteria contained in Section C of this appendix that are potentially affected by the upgrade or modification. FRA will consider a performance criterion not to be potentially affected if a preliminary engineering analysis or other pertinent data establishes that the modification or upgrade will not change the performance of the older model ERMM against the performance criterion in question. The manufacturer shall retain and make available to FRA upon request any analysis or data relied upon to satisfy the requirements of this paragraph to sustain an exception from testing.

[70 FR 37942, June 30, 2005]

APPENDIX E TO PART 229—PERFORMANCE CRITERIA FOR LOCOMOTIVE CRASH-WORTHINESS

This appendix provides performance criteria for the crashworthiness evaluation of alternative locomotive designs, and design standards for wide-nosed locomotives and any for other locomotive, except monocoque/semi-monocoque design locomotives and narrow-nose design locomotives. Each of the fol-

lowing criteria describes a collision scenario and a given performance measure for protection provided to cab occupants, normally through structural design. Demonstration that these performance criteria have been satisfied may be accomplished through any of the methods described in §229.205. This performance criteria is intended to prevent intrusion into the cab seating area occupied by crews. This excludes inner and outer vestibule areas.

(a) *Front end structure (collision posts)*—(1) *Objective.* The front end structure of the locomotive must withstand a frontal impact with a proxy object which is intended to simulate lading carried by a heavy highway vehicle (see figure 1).

(2) *Proxy object characteristics and orientation.* The proxy object must have the following characteristics: Cylindrical shape; 48-inch diameter; 126-inch length; 65,000 pound minimum weight; and uniform density. The longitudinal axis of the proxy object must be oriented horizontally perpendicular to the longitudinal axis of the locomotive.

(3) *Impact and result.* The front end structure of the locomotive must withstand a 30-mph impact with the proxy object resulting in no more than 24 inches of crush along the longitudinal axis of the locomotive, measured from the foremost point on the collision post, and with no more than 12 inches of intrusion into the cab. The center of impact must be 30 inches above the top of the locomotive underframe along the longitudinal centerline of the locomotive.